UIT2201: CS & the IT Revolution
Tutorial Set 6 (Fall 2016)

(D-Problems discussed on Friday, 16-Sep-2016)
(Q-Problems due on Tuesday, 27-Sep-2016)

Discussion Problems: -- Prepare (individually) for tutorial discussion.

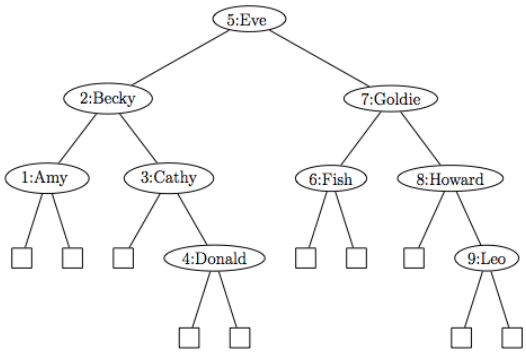
T6-D0: Complete problem T5-D3 (especially the part on binary search).

T6-D1: (Analysis of Binary Search) (Variant of Problems 17, 21 p.122 of [SG3])
(Read lecture notes on Binary Search, & Sect. 3.4.2 of [SG3], esp. Fig 3.19.)

You are given the following 9 names to be searched using the **binary search** algorithm.

```
Amy, Becky, Cathy, Donald, Eve, Fish, Goldie, Howard, Leo,
```

The search tree below can be used to *visualize* the **binary search** algorithm. Note that we also draw 10 "fictitious" square-nodes that corresponds to "unsuccessful searches".



(a) For each name in the list, how many comparisons are needed for its (*successful*) search?
(b) Compute the *average* number of "name-comparisons" needed in a (*successful*) search, assuming that each name is *equally likely* to be searched.

Now, we consider unsuccessful searches: If we search for a name that is not in the list, we get an *unsuccessful* search. Between the 9 names in the list, there are (9+1) gaps. They are

Gap1 -- names that are smaller than `Amy`,
Gap2 -- those between `Amy` and `Becky`,
Gap3 -- those between `Becky` and `Cathy`,
. . . ,
Gap9 -- those between `Howard` and `Leo`, and finally
Gap10 -- those greater than `Leo`.

If you search for `Billy` (a name in Gap3 -- between `Becky` and `Cathy`), the search will "end up" at the 3rd square-node.

(c) For each of the 10 gaps, how many comparisons are needed for its (*unsuccessful*) search?
(d) Assuming that each gaps is *equally likely* to be searched, what is the *average* number of "name-comparisons" used in a (*unsuccessful*) search?

T6-D2: (Analysis of Sequential Search) (Variant of Problems 5 p.121 of [SG3])
[Same as Problem T6-D1, but use **Sequential search** instead of **Binary Search**.]

You are given the following 9 names to be searched using the **sequential search** algorithm.
(See Section 3.3.1 (pp.84-89) of [SG3] and Problem 5 (p.121) of Ch. 3.)

```
Amy, Becky, Cathy, Donald, Eve, Fish, Goldie, Howard, Leo
```

(a) Draw the search tree tree that can be used to *visualize* the **sequential search** algorithm. Include also the "fictitious" square node for unsuccessful searches.

(b) For each name in the list, how many comparisons are needed for its (*successful*) search?
(c) Compute the *average* number of "name-comparisons" needed in a (*successful*) search, assuming that each name is *equally likely* to be searched.

(d) For each of the 10 gaps, how many comparisons are needed for its (*unsuccessful*) search?
(e) Compute the *average* number of "name-comparisons" needed in an (*unsuccessful*) search, assuming that each gap is *equally likely* to be searched.

Practice Problems: (not graded)

PP-problems will help you to "ease into" the materials covered in the course. *(If you have difficulties with these practice problems, please **quickly** see your classmates or the instructor for help.)*

T6-PP1: Probs 6 on page 121 (Ch3) of [SG].

T6-PP2: Problem 17, 21 of (Ch3), page 122 of [SG3].

Problems to be Handed in for Grading by the Deadline:

(**Note:** Please submit *hard copy* to me. Not just soft copy via email.)

T6-Q1: (10 points) (Analysis of Binary Search)
You are given the following 11 sorted numbers to be searched using the **binary search** algorithm.

```
5, 8, 13, 21, 34, 47, 55, 61, 75, 89, 97
```

(a) Draw the search tree tree that can be used to visualize the **binary search** algorithm.

(b) For each name in the list, compute the number of comparisons needed for its (*successful*) search?

(c) Compute the *average* number of "name-comparisons" used in a (*successful*) search, assuming that each name is *equally likely* to be searched.

(d) For each of the 12 gaps, how many comparisons are needed for its (*unsuccessful*) search?

(e) Compute the *average* number of "name-comparisons" used in an (*unsuccessful*) search, assuming that each gap is *equally likely* to be searched.

T6-Q2: (10 points) (Analysis of Sequential Search)
Repeat T6-D2, but assuming that you are given the following 11 sorted numbers to be searched (also using the **sequential search** algorithm).

```
5, 8, 13, 21, 34, 47, 55, 61, 75, 89, 97
```

T6-Q3: (10 points) (Spring 2012 Exam Q4)
Spring 2012 Exam Q4 Parts (a)-(c).

~~**T6-Q4: (10 points) (Coming soon -- check again for updates)**~~ --- Cancelled!

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